LESSON PLAN

Patterns & Relationships: Finding and Generalising Rules

Explicit teaching — I Do (~15 min)

The goal is to move students from describing the *step* of a pattern ("add 3") to a **general rule** that links any position directly to its term.

1. Building patterns WA6MNAP1

Make a growing pattern with matchsticks: 1 square uses 4 sticks, 2 squares use 7, 3 squares use 10. Record position against count in a table.

Growing Pattern → Generalising the Rule

Term 1 Term 2 Term 3

Position (n): 1 2 3 4 n

Sticks: 4 7 10 13 3n + 1

Rule: multiply the position by 3, then add 1 → 3n + 1

From a built pattern to a position-to-term table to a general rule.

2. Spotting the rule

> **Worked example.** The pattern grows by 3 each time. Writing the rule in words: "multiply the position by 3, then add 1". Test it: position 1 → $3\times1+1=4$; position 4 → $3\times4+1=13$. In symbols this is $3n+1$.

3. Decreasing patterns

> **Worked example.** For $30, 27, 24, 21, \ldots$ the rule is "start at 30 and subtract 3 each time", or in general "$33-3n$". Check position 1: $33-3=30$. ✓

Guided practice — We Do (~20 min)

1. **Grow it together.** Build a triangle-tile pattern as a class and fill the position/count table to 5 terms.
2. **Predict term 10.** Use the rule to jump ahead without building, then verify by extending the pattern.
3. **Words to rule.** Convert several verbal descriptions into a position rule, and rules back into words.
4. **Make a decreasing pattern.** Pairs design one decreasing pattern, tabulate it, and write the rule in words.

> Prompt the leap to generalisation by asking: "Without listing every term, how would you find position 100?" This forces a rule rather than repeated addition.

Independent practice — You Do (~15 min)

Students complete the worksheet:

- continue three given patterns (two increasing, one decreasing) for three more terms;
- complete position/term tables;
- write the rule for each in words;
- use a rule to find the 10th and 20th terms without drawing.

> **Exit ticket.** For the pattern $5, 9, 13, 17, \ldots$ write the rule in words and find the value at position 6.

Teacher notes

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Curriculum link: WA6MNAP1.

Materials: matchsticks or toothpicks, square tiles, pattern tables, grid paper.

Common misconceptions

- Describing only the recursive step ("add 3") without relating a term to its *position* — push toward position-to-term rules.
- Assuming the constant (the $+1$) is part of the multiplier.
- Thinking the rule must involve multiplication only.

Assessment for learning: the "find term 10 without drawing it" task reveals who can generalise versus who is still counting on.

Approaches

KINESTHETIC · MANIPULATIVE-BASED APPROACH

Manipulative-based approach

Lead with manipulatives so the pattern's *structure* is built before it is recorded in a table.

Build each stage. Students physically construct each term with tiles or matchsticks and place it beside a numbered position card.

Separate the growing part from the constant. Grow the shape by adding the repeating piece each time, then point to the constant starting piece that never changes — this distinguishes the multiplier from the $+\ constant$.

Rule machine. One student calls a position; the partner physically assembles that term to prove the rule works.

Two-colour tiles. Make the part that grows one colour and the constant part another, so the structure of $3n + 1$ is visible in the materials.

DIGITAL · DIGITAL: SPREADSHEET PATTERN EXPLORER

Digital: Spreadsheet Pattern Explorer

This approach uses a spreadsheet (or a free online sheet on tablets) so students can generate, extend and test number patterns instantly — ideal for learners who are motivated by technology and like to experiment.

Build a pattern. In cell A1 type the first term. In A2 type a formula such as =A1+2 and fill down. Students watch the L-shaped dot pattern 3, 5, 7, 9... appear and confirm the term-to-term rule by changing the $+2$ and seeing what happens.

Test a position-to-term rule. In column B, students type a formula using the row number, e.g. =2*ROW()+1, and check it matches column A. This makes the difference between term-to-term and position-to-term rules concrete and visible.

Function machine simulator. Label C1 “input” and D1 “output”, then in D2 enter a two-step rule such as =C2*3-1. Students type inputs and instantly see outputs, then race a partner to guess each other’s hidden rule.

Why it works. Instant recalculation gives students a feedback loop: change the rule, see every term update. This builds the leap from “add 2 each time” to a general rule far faster than recalculating by hand.

Keep the focus mathematical: ask students to *predict* the next value before they fill down, so the spreadsheet checks their thinking rather than replacing it.